

CLAIMS

1 1. Position detection apparatus, comprising:

2 an accelerometer for providing an acceleration signal representative of acceleration of
3 a movable element,

4 a combining network having an acceleration input for receiving said acceleration
5 signal, a position input for receiving a position signal representative of position of said
6 movable element, and an output for providing an inferred position signal representative of an
7 inferred position of said movable element,

8 said network including a first signal processor for processing said acceleration signal
9 to provide a modified acceleration signal, said first signal processor comprising a low-pass
10 filter,

11 a second signal processor for processing said position signal to provide a modified
12 position signal, and

13 a combiner for additively combining said modified acceleration signal with said
14 modified position signal to provide said inferred position signal.

1 2. Position detection apparatus in accordance with claim 1, further comprising:

2 a second accelerometer, for providing a reference element signal representative of
3 acceleration of a reference element;

4 a differential acceleration measuring element, comprising

5 a first acceleration input for receiving said movable element acceleration signal,

6 a second acceleration input for receiving said reference element acceleration signal,

7 and

8 an output for providing a differential output signal representative of a differential
9 acceleration of said movable acceleration signal and said reference element acceleration
10 signal,

11 wherein said combining network acceleration input is for receiving said differential
12 acceleration signal, and

13 wherein said combining network first signal processor is for processing said
14 differential acceleration signal to provide said modified acceleration signal.

1 3. Position detection method for processing an acceleration signal and a measured
2 position signal representative of acceleration and position, respectively, of a movable element to
3 provide an inferred position signal comprising:

4 low-pass filtering said acceleration signal; and
5 additively combining the low-pass filtered acceleration signal with said position signal
6 to provide said inferred position signal.

1 4. Position detection method in accordance with claim 3, wherein said acceleration
2 signal is a movable element signal representative of acceleration of a movable element, and
3 wherein said method is further for processing a reference element signal representative of
4 acceleration of a reference element, said method further comprising:

5 differentially combining said movable element acceleration signal and said reference
6 element acceleration signal to provide a differential acceleration signal representative of
7 differential acceleration of said movable element and said reference element;

8 low pass filtering said differential acceleration signal; and
9 additively combining the low pass filtered acceleration signal with said position
10 signal to provide said inferred position signal.

1 5. Closed loop motion control apparatus, comprising:
2 a movable element having a position,
3 an accelerometer for providing an acceleration signal representative of acceleration of
4 said movable element,

5 a combining element, for combining a reference position signal and an inferred
6 position signal to provide an error signal,

7 a controller, for providing a control signal responsive to said error signal,
8 an actuator, for applying a force, responsive to said control signal, to said movable
9 element to change said position, said force resulting in said acceleration of said movable
10 element,

11 a feedback loop, for providing said inferred position signal, said feedback loop
12 comprising a combining network for providing said inferred position signal, said combining
13 network including

14 an acceleration input for receiving said acceleration signal,

15 a position input for receiving a position signal representative of position of said
 16 movable element, and
 17 an output for providing an inferred position signal representative of an inferred
 18 position of said movable element,
 19 said network including a first signal processor for processing said acceleration signal
 20 to provide a modified acceleration signal, said first signal processor comprising a low-pass
 21 filter,
 22 a second signal processor for processing said position signal to provide a modified
 23 position signal, and
 24 a combiner for additively combining said modified acceleration signal with said
 25 modified position signal to provide said inferred position signal.

1 6. Closed loop motion control apparatus in accordance with claim 5, further
 2 comprising
 3 a reference element,
 4 a second accelerometer, for providing a reference element acceleration signal
 5 representative of acceleration of said reference element;
 6 a differential acceleration measuring element, comprising
 7 a first acceleration input for receiving said movable element acceleration signal,
 8 a second acceleration input for receiving said reference element acceleration signal,
 9 and
 10 an output for providing a differential output signal representative of a differential
 11 acceleration of said movable acceleration signal and said reference element acceleration
 12 signal,
 13 wherein said combining network acceleration input is for receiving said differential
 14 acceleration signal, and
 15 wherein said combining network first signal processor is for processing said
 16 differential acceleration signal to provide said modified acceleration signal.

1 7. Open loop position detection apparatus, comprising:
 2 an accelerometer for providing an acceleration signal representative of acceleration of
 3 a movable element,

a combining network having an acceleration input for receiving said acceleration signal, a position input for receiving a position signal representative of position of said movable element, and an output for providing an inferred position signal representative of an inferred position of said movable element,

said network including a first signal processor for processing said acceleration signal to provide a modified acceleration signal, said first signal processor comprising a low-pass filter,

a second signal processor for processing said position signal to provide a modified position signal, and

a combiner for additively combining said modified acceleration signal with said modified position signal to provide said inferred position signal.

8. Open loop position detecting apparatus in accordance with claim 7, further comprising

a second accelerometer, for providing a reference element acceleration signal representative of acceleration of a reference element;

a differential acceleration measuring element, comprising

a first acceleration input for receiving said movable element acceleration signal,

a second acceleration input for receiving said reference element acceleration signal,

and

an output for providing a differential output signal representative of a differential acceleration of said movable acceleration signal and said reference element acceleration signal,

wherein said combining network acceleration input is for receiving said differential acceleration signal, and

wherein said combining network first signal processor is for processing said differential acceleration signal to provide said modified acceleration signal.